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"Learning by Dining"

Informal Networks and Productivity in Mexican Industry

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Abstract

Lall and Ghosh analyze the determinants of firm productivity in a group of Mexican firms. In particular, they test the contribution of external factors such as trade and knowledge diffusion, the availability of infrastructure, informal knowledge exchange, competitive environment, and business regulatory climate. The authors find that one factor consistently emerges as an important proximate source of productivity—access to informal networks. Interaction in the form of "business lunches" with local buyers and suppliers, competitors, government officials, and other professionals have a significant and positive effect on a firm's productivity. Access to regulators and agents of backward and forward linkages are important in settings where information on business practices and regulations is not publicly disclosed. The results complement predictions of traditional growth theory—in addition to technology and learning being the driving force of firm productivity, proximity to influential individuals who can grant favors or provide information advantage on business and trade practices have significant productivity impacts.

This paper—a product of Infrastructure and Environment, Development Research Group—is part of a larger effort in the group to understand the role of economic geography and urbanization in the development process. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Yasmin D'Souza, room MC2-622, telephone 202-473-1449, fax 202-522-3230, email address ydsouza@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. Somik Lall may be contacted at slall1@worldbank.org. February 2002. (26 pages)

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Informal networks and productivity in Mexican industry[+]

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I. Introduction

What are the proximate sources of firm level productivity? Do factors beyond the direct production process contribute to productivity? More specifically, do factors such as human capital, trade and technology flows, availability and quality of infrastructure, and access to informal networks matter? Both traditional predictions from growth theory (Solow, 1956, 1997, 1989) and new insights from the work on endogenous growth (Romer, 1986, 1990) and economic geography (Krugman, 1991) indicate that these 'external' factors have important productivity effects.

In this paper, we examine the contribution of these 'external' factors to productivity in a sample of Mexican firms. In particular we directly want to test if firm level productivity is influenced by:

- Trade and knowledge diffusion
- Availability and quality of infrastructure
- Informal knowledge exchange
- Competitive environment
- Business regulatory climate

We test these hypotheses using data from a sample of 108 firms in three Mexican cities – 34 firms in Guadalajara, 35 in Hermisillo, and 28 in Tijuana[1]. The stratified

[1] Tijuana is located in the northern part of Mexico bordering the US. As a result of its relatively low wages, it has traditionally served as subassemblies for Los Angeles based textiles and electronic firms. Wages in Tijuana are higher than those in other part of the country, especially in central Mexico. Guadalajara is the third largest industrial city of Mexico. Most firms are family-owned and are small scale ventures. Finally, Hermosillo has a large agriculture sector. Business has strong local linkages; a fact that proved to be a

sample mainly consists of small and medium scale firms. Information on various aspects of performance and characteristics of these firms were collected during 2-hour long interviews with directors and owners of the firm in 1993. Additional background information was collected from SECOFI (Economic secretariat of Mexico), industrial chambers, and state development organizations.

Following comprehensive trade liberalization measures adopted by Mexico in 1986, the 1990s were a period of economic restructuring with enhanced competition. Liberalization measures were accompanied by constraints such as expensive credits, strict and unstable fiscal policy, exchange rate protection, low consumer purchasing power, and the government's favoritism for foreign investment over domestic investment, thereby making it harder for the firms to adapt to the transition (Musik, 1993).

Predictions from growth theory suggest that productivity (especially labor productivity) is enhanced by 'learning by doing', where workers learn continuously from prior experience through a process of discrete 'innovations'. Consequently, labor per unit of capital reduces with increases in capital investment, and with each discrete innovation. Solow (1956, 1997) argues that increased capital-intensive investment is embodied in new machinery, research and development investment, and learning on the job that leads to productivity enhancement. As workers continue with the same job, they devise small improvements that accumulate over time, and this results in more efficient way of doing the same job. *Our analysis of Mexican firms however shows that in addition to 'learning by doing', firms are 'learning by dining'.* While technology adoption and experience of workers on the job do not emerge as being important; informal networks in the form of lobbying influential government officials and professional organization have significant productivity benefits. In fact, one standard deviation increase in the *dining frequency* with influential individuals (measured as number of business lunches) increase increases labor productivity by 28,000 pesos/worker.

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disadvantage for the beef industry when all the upstream and downstream industries declined as a result of downtrend in beef industry (Musik, 1993).

The rest of the paper is organized as follows: In Section II, we discuss the analytic framework based on traditional and augmented growth models. We discuss why external factors might contribute to productivity, including degree of informal knowledge exchange, availability of infrastructure, and business regulations. Section III provides a description of the variables used in the analysis as well as articulates the econometric specifications. Section IV describes the results of the empirical analysis. Section V concludes.

II. Analytic Framework

We start the analysis from the firm's basic production function, which can be represented by:

$$Y_i = X(K, L) \qquad (1)$$

where Y is the output of firm *i*, and K and L are capital and labor inputs. While the immediate production inputs determine firm level output, contributions to productivity are also made by factors that are outside the immediate production process. Some of these proximate sources of growth include market competition, business regulatory climate, human capital, available technology, availability and quality of infrastructure, and access to informal networks.

Neo classical models of growth predict that trade and technology adoption have positive impacts on productivity. As firms engage in trade, they are likely to improve technical efficiency and adopt some of the technological innovations of their trading partners. The contribution of human capital has been established following extensions of the Solow model (see Mankiw, Romer, and Weil, 1992), where human capital accumulations positively influences physical capital investment at a steady state of output (Aghion and Howitt, 1998). The role of infrastructure availability and quality can be factored in by expanding the definition of capital, and possibly distinguishing between private firm level capital and publicly supplied infrastructure.

Clustering and co-location of firms in particular areas is suggestive of the existence of Marshallian externalities, which have become the focus of the new economic

geography literature (Fujita and Thisse, 1996). In principle, co-location in geographic space enhances interaction with and access to buyer-supplier networks, government officials, and competitors. In the sense of Marshallian technological externalities, location of firms in the same geographical region allows them to benefit from informal knowledge exchange, thereby enhancing productivity.

The competitive environment also influences productivity. The predicted impacts in the literature however are contradictory. Lucas (1988) posits that with increased competition and movement of workers between firms, workers will outgrow old products rapidly. Consequently, there will be enhanced demand for research to absorb workers into new methods of production. In addition, more firms are associated with more technology externalities and higher growth. On the other hand, the basic Schumpetrian model assumes that competition adversely affects growth. With more competing firms in the industry, monopoly rents associated with successful innovators will be reduced dampening their incentive to innovate. In addition to competition, the business regulatory climate also influences output and productivity. A number of studies have indicated that institutional framework has significant and large effects on the economic efficiency and growth rate of economies (e.g. Scully, 1988). Pro-business regulations and functioning institutions lower transactions cost and transformation cost in production.

To take into account these additional factors that influence productivity, we modify the production function in (1):

$$Y_i = g(A_i)X(K,L)H \qquad (2)$$

where $g(A_i)$ includes external influences on firm output – infrastructure (K_2), business regulatory climate (B), competitive structure (C), informal knowledge networks (I). Thus,

$$G(A_i) = f(K_2, B, C, I) + \varepsilon_i \quad (3)$$

$X(K,L)$ includes the basic inputs – private capital and labor , and **H** represents measures of human capital.

Following the preceding discussion, we posit that

$\frac{\partial Y_i}{\partial K_2} \geq 0$; $\frac{\partial Y_i}{\partial B} \geq 0$; $\frac{\partial Y_i}{\partial I} \geq 0$ and $\frac{\partial Y_i}{\partial H} \geq 0$. Further $\frac{\partial Y_i}{\partial C} \geq ?$ as we do not have strong priors on the role of enhanced competition.

Finally, the labor productivity of the firm is measured Y/L=y and

$$y = g(a)X(k)h \qquad (4)$$

III. Variable Definition and Econometric Specification

A. Variable definition and data description

Trade and knowledge diffusion (LABOR, FIRM) : The destination of finished products and source of inputs are important determinants of productivity. In general, output consumed within the city where the firm is located has declined over time, from an average of 46% in 1990 to 27% in 1995. Concomitantly, the share of output sold outside the province but within Mexico has increased from 37% to 42%. With respect to the source of inputs, the share of imports increased from 45 to 50% during the period 1990-95. During the same period, the share of inputs bought from within the city declined marginally from 10 to 9%. Descriptive statistics and variable definitions are provided in Appendix 1.

Exports, as a proportion of total sales is highest in Tijuana (77%) in comparison to the other two cities. Further, average firm size measured in sales is largest in Guadalajara, followed by Hermisillo and Tijuana respectively. In terms of employment, the average number of employees is also highest in Guadalajara followed by Hermisillo and Tijuana. Out of the 108 firms in the sample, 58% were part of a business enterprise group and 19% had joint venture partners. On average, 16% of the output was sold to a principal domestic buyer and 25% to a principal foreign buyer. The firms in our sample have a dominant principal product, which in general accounts for about70% of all sales. However, there are a wide range of varieties of the dominant product, which on average increased from 56 to 86 between 1991-92 and 1993-94.

Human capital (LABOR): Education attainment measured by schooling, ranges from primary school or less to university education. Predictably, the level of education attainment is highest among managers. On average, education level of managers is between high school/technical school and university. Experience is measured by length of service within the firm and prior experience. Managers also have the most experience; a typical manager has 5 years experience prior to joining the firm. In addition, the average length of service is also highest for the manager at 8 years. On the other hand, average length of service and prior experience is considerably lower for production workers and supervisors.

Training programs exist, both within and outside the firms for supervisors and technicians. But there is no training at managerial levels though there is at supervisor and technician level. Out of the 108 firms in the sample, about 51% firms sent plant supervisors and technicians/engineers to domestic formal training institutions. Out of these employees, 90 employees were trained at government vocational schools, 250 in private vocational schools, and 111 in universities. Each supervisor received an average of 18 hours of training and each technician received 13 hours of training within Mexico in the year 1992-93. Production workers are also trained, and they spend significant amount of time in the initial months to learn new processes in the firm. New production workers who joined the firm spent an average of 55% of their time in training in the 1^{st} month, 10% in the 2^{nd} month, and 5% in the 12^{th} month of the job. But training of employees also increases their marketability and they often leave, consequently, labor rotation is high. Employee turnover is highest for production workers, followed by technicians, supervisors, and managers respectively.

Availability and quality of infrastructure (INF): Infrastructure variables relate to quality of electricity, water, and telephone. It is measured by limits to availability and service interruptions. In terms of service interruptions, Guadalajara was worst off among the three cities. Out of the 34 firms surveyed in Guadalajara, only 4 had limits of availability in electricity, 6 had limits on water, and 6 had limits on telephone. Only 1 out of 34 firms surveyed had limits on all three types of infrastructure. There were about 18 service interruptions in 1992 on average for electricity, 4 for water, and 15 for telephone.

Current location advantages and disadvantages (LOC) : The respondents considered government subsidies, level of rents and space, and extent of congestion to be disadvantages of the current location. This is true for all the three geographical locations. The extent of contact with international customers was favorable and rest of the variables either had no effect or was mildly favorable. Businessmen in Guadalajara considered availability of high quality workers and informal links with local businessmen to be advantages of the current location. The informal links with local businessmen has emerged as a significant location advantage for businessmen in Tijuana.

Formal and informal knowledge exchange (NETWORKS): Formal and informal networks are measured by number of visits to chambers of commerce and business lunches and other social engagements with local buyers and suppliers, foreign buyers and suppliers, foreign machinery supplier, competitors, government officials, and others. Forming networks have traditionally been an important part of conducting business in Mexico. The number of visits each year measures the participation in the institutionalized chambers of commerce. The mean number of visits is highest to the national chambers of commerce at 2-5 times a year. Visits to other chambers of commerce are either never or once a year. Business lunches and other social engagements with other professionals is highest, the mean business lunches and other social engagements is are about 2-5 times a year, Similarly employees share 2-5 business lunches with local buyers and suppliers, foreign buyers and suppliers, and with government officials. Other social engagements are about once a year with local buyers and suppliers, foreign buyers and suppliers, competitors, and with government officials.

Competitive Environment and Business Regulatory Climate (COMP, PE): Competitors in the city increased in the period 1990-95, while the number of competitors in the country declined during the same period. On average, competition for the same product increased in 1995 from the 1990 levels. This is true for competition within the city, state, and the whole economy. On average, the number of competitors within the city increased during 1990-92 but declined in 1995. Number of competitors within the state and within Mexico remained almost static during this period. Policy environment relates to the effect of

government regulations on firm productivity. On average, the firms surveyed perceived the government policies and regulatory instruments such as import-export licenses, price controls, and labor regulation to be obstacles to productivity and development.

B. Empirical testing

In our framework, firm level productivity is determined by capital stock and technology. Based on the survey data, we have used investment in 1992 as a proxy for capital stock and the age of machinery and number of workers in new product development as proxies for technology development of the firm. New machinery and higher number of specialized employees in new product development are critical indicators of technological innovation in the firm. Thus,

Labor productivity = f (capital stock, technology) (5)

$y = f(k, t)$

To this basic framework, we add groups of variables representing proximate sources of productivity enhancement – human capital and firm related attributes, infrastructure, formal and informal networks, technology, competitive and policy environment, location, and destination of outputs and source of inputs. We used an F – test to analyze the joint significance of these variables. Results from the F-tests are presented in Table 1. Surprisingly, we find that human capital related characteristics such as education, length of service in the firm, and prior experience do not have significant effects on firm level productivity. The F-value of 0.83 is less than the critical value ((2.68 at .05 level of significance) Infrastructure has significant productivity effects -- both the OLS and 2SLS results represent the importance of infrastructure in explaining labor productivity. The infrastructure variables used are service interruptions in electricity, water, and telephone. The variables are jointly significant and the F-value is 2.87 in the OLS estimation. The infrastructure variables in 1992 have been instrumented by infrastructure in 1990 in the 2SLS model. The F-value at 2.50 is significant at 10% level of significance. The competitive structure in the form of competition in the city, state, within Mexico does not emerge as a significant variable with the F-value being 1.87.

As evident from our regression analysis, formal and informal networks are major determinants of labor productivity with the F-value being 3.94 significant at 1% level of significance. Firm specific characteristics such as dummy for member of an enterprise group and domestic and foreign partner also emerge significant. The destination of outputs (within the state, in Mexico, and foreign exports) and source of inputs however, are strong determinants of firm performance. The corresponding F-value is 5.51. Policy environment does not emerge as a relevant variable affecting labor productivity. The F-value at 1.82 is significant in case of the location advantages of the firm. This supports the notion that the firms gain from agglomeration economies.

Table 1: Test of joint significance

Groups of variables	***F-value***
LABOR – Labor related attributes (education, length of service, prior experience)	$F_{3,99} = 0.83$
FIRM - Firm related attributes (dummy for member of group of firms, local and foreign partner)	$F_{3,99} = 3.42$**
NETWORKS - Formal and informal networks	$F_{3,90} = 3.94$***
TECH – No. of workers in new product development	$F_{1,101} = .86$
INF - Infrastructure (OLS) Infrastructure (2SLS)	$F_{3,97} = 2.87$** $F_{3,97} = 2.50$*
COMP – Competitive environment	$F_{3,91} = 1.87$
BUS_REG - Business regulatory/policy environment	$F_{1,92} = .04$
DES_OUT - Destination of output	$F_{3,99} = 5.51$***
SOURCE_INP – Source of inputs	$F_{3,99} = 0.72$
LOC_ADV - Location advantages	$F_{9,91} = 1.82$*

*** - significant at 1% level
** - significant at 5% level
* - significant at 10% level

The results above are confirmed by regression analysis. The empirical model used for estimation is:

$$LAB\_PROD = \beta_0 + \beta_1 LABOR + \beta_2 NETWORKS + \beta_3 COMP + \beta_4 TECH + \beta_5 INF + \beta_6 FIRM + \beta_7 DES\_OUT + \beta_8 SOURCE\_INP + \beta_9 LOC\_ADV + \beta_{10} BUS\_REG + \varepsilon \quad (6)$$

We assume a heteroscadastic error structure, where the conditional variance of LAB_PROD_i is not constant across values of explanatory variables. Symbolically,

$$E(\varepsilon_i^2) = \sigma_i^2$$

Results from the ordinary least squares (OLS) and two-stage least squares (2SLS) estimation estimations are reported in Tables 2, 3, and 4.

IV. RESULTS

A. OLS estimation

The dependent variable used in the analysis is labor productivity (Sales/employees). In each model, we have successively added variables to test the additional effect of each group of variables. Model (1) is insignificant with education, length of service, and experience explaining negligible portion of labor productivity. In model (2), we regress labor productivity on education, length of service, experience formal and informal networks. Formal meetings with chambers' of commerce and informal business lunches with buyers, suppliers, competitors, government officials, and other professionals have positive and significant effects on labor productivity. Each standard deviation increase in visits to formal meetings increases labor productivity by about 19,000 pesos/worker[2] and each standard deviation increase in number of informal business lunches increases labor productivity by 26,000 pesos/worker.

In model (3) we add the number of competitors in the city, state, and within Mexico and add number of employees in new product development in model (4). We include these variables to analyze how competition and technological innovation influences productivity. The coefficient of informal business lunches remained positive and significant in both the models. Each standard deviation increase in informal interactions increases labor productivity by 26,000 and by 25,800 pesos/worker respectively. If the average number of informal business lunches doubles to 5 per year from the 2.5 meeting presently, then worker productivity will increase by 125,000 pesos/worker. As evident, the number of competitors with the city, and within the state does not affect productivity significantly. The results also confirm Musik's (1993) argument that technology is not generated within Mexico's firms. The coefficient of the variable for technological innovation -- number of workers employed for new product development remained insignificant in all model variants. As Musik (1993) further notes,

[2] calculated by multiplying the standard deviation with the regression coefficient, in this case -- 0.95*20.28

there is not much technology generated within the Mexican firms, and there is hardly any transfer of technology within firms. The *maquilodora* industry uses the capital intensive techniques developed elsewhere. They are involved in mostly manufacturing and JIT processes that involve fewer linkages with the local economy than with more labor-intensive processes. But these processes help in the upgradation of skills of the workers. The workers have been very adaptive to learning new technologies. Further, the technology development is responsive to external stimulus as there is hardly any technology research within the firms.

In model (5), we added the infrastructure variables – service interruptions in electricity, water, and telephone. None of the infrastructure variables are significant. As Musik (1993) noted, firms do not perceive infrastructure to be a barrier. Either they have become used to inadequate infrastructure or the infrastructure is truly tailored to business needs. The informal interactions with influential individuals continued to be significant; one standard deviation increase in 'number of business lunches' increases labor productivity by 28,000 pesos/worker. Productivity will be 134,000 pesos per worker if the average number of business lunches doubles to 5 meetings and 201,000 pesos per worker if it triples to 7.5 meetings per year.

In model (6), we included the firm specific characteristics like whether the firm is a member to a group of companies and whether the firm has domestic or foreign partners. Firms with a domestic partner perform better in models where additional variables are included in models (8), (9), (10) and (11). But performance was not significantly influenced by the presence of a foreign partner. We expected that firms with external linkages in the form of financing and technical assistance from foreign firms would perform better in the period of transition. The results however are not surprising considering the fact that most of the firms in the sample are small and medium sized firms while most of the joint ventures have been formed by large firms.

In models (7) and (8), we added destination of output and source of input variables in the estimation of productivity. This model accounts for the trade that the firm undertakes both in terms of its output and input. Interestingly, all the output or sales

variables are significant. One standard deviation increase in percent of output sold within the state increases labor productivity by 46,000 pesos/worker, one standard deviation increase in percentage of output sold within Mexico increases the labor productivity by 56,000 pesos/worker and one standard deviation increase in percentage of output exported increases the labor productivity by 34,000 pesos/worker. These variables remain significant even after additional variables are introduced. Business confidence is buoyed by the belief that final products are destined for domestic and foreign markets. Destination of output is an indicator of demand for products in domestic and international markets. But none of the source of input variables is significant. Where the inputs come from does not affect labor productivity.

In model (9), we introduced the variables that proxy for the location advantages of the firm. Out of the 9 location variables, only 'availability and quality of infrastructure services' affects labor productivity positively and significantly. One standard deviation increase in the access to infrastructure in the current location will increase labor productivity by 15,250 pesos/worker. Finally in model (10), we added the policy environment index, which is created by averaging the three policy environment variables -- obtaining licenses for imports, requirement to meet export targets, and controls on prices of output. Surprisingly, the coefficient of this index was not significant. This full model puts forth interesting results -- education and length of service negatively affect productivity. We posit that since productivity is not enhanced by on the job experience and education levels, having labor with higher job experience and education will be costly. Formal and informal networks emerge as being consistently significant. It is evident that visiting chambers of commerce and informal interactions with influential individuals are associated with productivity gains. Destination of output within the state and within Mexico also affects productivity. As with model (8), infrastructure is a major location advantage. Availability of superior quality infrastructure affects productivity significantly.

B. 2SLS estimation

As evident, the causality between infrastructure and firm productivity is two-way. While infrastructure influences productivity, higher productivity firms would also chose to locate in infrastructure abundant locations. Infrastructure is likely to be an endogenous variable as a firm's decision to locate in a region depends on perception of infrastructure availability. A region with growing firms will invest more in infrastructure than otherwise. Firms decide where to locate based on access to infrastructure that in turn affects their productivity. To control for endogeneity, we instrumented for infrastructure variables in 1992 by using lagged values --- infrastructure variables in 1990.

The 2SLS results are presented in model (11) in Table 4. But infrastructure continued to be insignificant in the regression, providing empirical support for Musik's (1993) claim that firms do not perceive infrastructure as a barrier to productivity. In addition, the business regulatory climate proxied by policy environment variables has been included. It is possible that infrastructure affects productivity significantly in the presence of a supportive policy environment. We interacted infrastructure variables with policy environment variables but it did not emerge significant. Among the LOC (location advantage) variables, availability and quality of infrastructure is a significant determinant of productivity in the current location. One standard deviation improvement in the access to infrastructure increases productivity by 17,500 pesos/worker. In addition, we want to test whether informal networks remain significant even when infrastructure decision is controlled for. One standard deviation increase in 'number of informal business lunches' increases the labor productivity by 22,400 pesos/worker ceterus paribus. *The result provides support to the view that location decisions are based on both access to infrastructure and on access to influential individuals.*

We have drawn strong conclusions regarding the role of informal networks in productivity. It is possible that the 'networks' variable is endogenous to the model, which can result in upward bias in the outcomes. Firms locate where the access to influential individuals is greater. We tested for endogeneity but the variable was found to be

exogenous. Our regression results are therefore robust. We did not have lagged values of variable or other suitable instruments in the survey to test if the results change.

V. Conclusions

In this paper, we examined potential external sources of productivity enhancements for a sample of firms in Mexican industry. We find one factor that consistently emerges as being the most important proximate source of productivity – *access to informal networks*. Interaction in the form of 'business lunches' with local buyers and suppliers, competitors, government officials, and other professionals have a significant and positive effect on a firm's productivity. This means that access to regulators and agents of backward and forward linkages are important in settings where information on business practices and regulations are not publicly disclosed and the firm's location choice is driven by access to these informal contacts. In addition, formal visits to chambers of commerce have a positive impact on firm's productivity. It is evident that formal linkages in the form of visits to city, state, and national chambers of commerce, government committees for business promotion, government committees of infrastructure planning, association of entrepreneurs and individual business associations, and others affect firm performance positively.

To some extent, our analysis of Mexican industry deviates from and complements the traditional expectations from growth theory. Technology and on the job learning and innovations do not emerge as the driving force behind the growth of the firm. The findings however are consistent with anecdotal evidence on Mexican industry – for example, Musik (1993) notes that technology in these firms is mostly imported from foreign firms and included in the firm's process only by small innovations to adapt to the local business environment. The management of technology however remains exogenous, and investment in research and development is negligible because of the high fixed cost and uncertain returns. In addition, employment in Mexico's small and medium firms is mostly in assembly line productions, where there is miniscule opportunity to reorganize the production structure. Consequently, these barriers limit innovation.

Thus, a firm's productivity is not determined so much by their competitive advantage as by their closeness to individuals who can grant favors or provide information advantage on business or trade practices. In Mexico, the way that the firms have adopted to stay in business is to increase or maintain access to these influential individuals. This serves as a barrier to entry for new firms, as there exists considerable sunk costs to develop such relationships before setting up business. These firms stay ahead in business compared to their competitors by maintaining these relationships. This follows from the Schumpeterian idea of creative destruction, where entrepreneurs constantly innovate rendering their rivals' ideas obsolete (Schumpeter, 1947). Firms who take their innovative ideas into the marketplace and destroy outmoded ideas and products used by previously successful firms create wealth. Thus by creating something new, successful innovators destroys the profits that motivated their predecessors. Successful innovators endeavor to create barriers that would prevent new generation of entrepreneurs from taking over. These barriers can take the form of preventing new ideas from reaching the public, or influencing lawmakers to pass legislation favorable to them (Aghion and Howitt, 1998).

As Caballero and Hammour (2001) note, there exists significant empirical evidence that 'creative destruction, driven by experimentation and the adoption of new products and processes when investment is sunk, is a core mechanism of development'. They further argue that underdeveloped and politicized institutions are a major impediment to a well-functioning creative destruction process, and result in sluggish creation, technological "sclerosis", and spurious reallocation. Evidence of this can be found in the Mexican experience. As Musik (1993) notes, there is negligible technology diffusion within firms or between firms of the same industry. There is no evidence of using technology as a competitive advantage. The Mexican firms are reactive to technology changes rather than proactive.

The internal technology creation is minimal -- most of the firms included in our sample import technology. Technology is not used as a leverage to build competitive advantage. On the other hand, connections with influential individuals facilitate firm growth. The firms are 'locked in' an interdependent web that includes the influential

individuals. On the other hand, connections with influential individuals facilitate firm growth. The firms are 'locked in' an interdependent web that includes the influential individuals. The number of controls leaves the bureaucrats with a lot of discretion to affect private economic activity through their control over dispensing of permits and licenses. This *rent seeking* phenomenon results in social loss which can be measured in terms of lobbying effort, efforts to get close to the decision-making bureaucrats, and making plans to move in/out of the affected activity (of say differential taxation) (Buchanan, 1980). This creates an interdependent institutional structure. After the economy has sufficiently moved down a particular path, the institutions are locked into one solution resulting in lower payoffs than other efficient solutions. Survivors are those who follow the same technology and move along the same path. In Mexican industry, no one wants to be first to develop new technology; most of the firms are followers rather than leaders.

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Table 2: OLS (Model 1-4)

	(1) OLS	*(2) OLS*	*(3) OLS*	*(4) OLS*
LABOR (Human capital characteristics)				
Education	8.48 (6.19)	-3.06 (6.07)	-4.05 (6.32)	-3.64 (6.28)
Length of service	1.91 (1.62)	.79 (1.71)	.56 (1.87)	.54 (1.92)
Experience	-2.41 (3.19)	-3.27 (3.55)	-3.25 (3.61)	-3.21 (3.55)
NETWORKS (Formal and informal networks)				
Formal visits		20.28* (11.96)	21.82* (13.01)	22.08* (13.55)
Informal business lunches		25.08** (9.51)	24.99** (10.17)	24.88** (10.15)
Informal other social engagements		1.28 (7.90)	.153 (9.15)	.27 (9.09)
COMP (Competitive environment)				
Within city			-.22 (.98)	-.12 (.93)
Within state			.27 (.78)	-.26 (.80)
Within Mexico			.07 (.07)	.07 (.07)
TECH (Technological innovation)				
No. of employees in new product development				-5.57 (19.43)
F-value *Adjusted* R^2	1.41 .02	2.54 .18	5.08 .18	4.52 .18

** - significant at 5% level
* - significant at 10% level
Note: robust standard errors are presented below the coefficients

Table 3: OLS (Model 5-9)

	(5) OLS	*(6) OLS*	*(7) OLS*	*(8) OLS*	*(9) OLS*
LABOR (Human capital characteristics)					
Education	-.69	-4.08	-5.64	-12.47*	-13.69*
	(6.97)	(6.39)	(6.69)	(6.93)	(7.25)
Length of service	.74	.82	-1.78	-1.33	-2.62
	(1.90)	(1.71)	(2.03)	(1.55)	(1.65)
Experience	-3.03	-2.64	-1.10	-1.22	-3.28
	(3.56)	(3.29)	(3.03)	(.67)	(3.39)
NETWORKS (Formal and informal networks)					
Formal visits	19.64	16.45	26.11*	26.78**	26.46**
	(13.28)	(12.46)	(13.95)	(13.60)	(11.96)
Informal business lunches	26.79**	30.04**	21.47**	19.32**	23.14**
	(10.96)	(11.52)	(8.51)	(8.19)	(10.13)
Informal other social engagements	-.84	-4.53	-10.98	-10.57	-13.27
	(9.15)	(10.17)	(11.37)	(11.37)	(11.83)
COMP (Competitive environment)					
Within city	-.06	-.01	.65	.93	1.02
	(1.22)	(1.23)	(.92)	(.77)	(.89)
Within state	.75	.26	1.31	1.34	.91
	(.85)	(.95)	(.98)	(.93)	(1.20)
Within Mexico	.02	.04	-.04	-.03	-.00
	(.08)	(.07)	(.07)	(.07)	(.12)
TECH (Technological innovation)					
Number of employees in new product development	-8.69	-.94	-7.37	-12.75	-7.75
	(20.80)	(22.1)	(22.64)	(25.23)	(28.34)
INF (Service interruptions in infrastructure provision)					
Electricity	.50	-.15	-.32	.03	.31
	(.43)	(.45)	(.41)	(.52)	(.59)
Water	-.67	-.88	-.72	.64	-.68
	(.55)	(.50)	(.45)	(.45)	(.55)
Telephone	.25	.05	-.10	.22	-.37
	(.34)	(.37)	(.35)	(.31)	(.36)
FIRM (Firm specific characteristics)					
Member of a group of firms		19.12	8.83	16.18	7.95
		(17.27)	(15.75)	(16.44)	(19)
Domestic partner		37.42	36.93	40.87*	46.46**
		(22.67)	(22.83)	(22.23)	(21.87)
Foreign partner		-12.12	-22.38	-19.64	-19.83
		(17.49)	(18.12)	(18.37)	(19.64)
DES_OUT (Destination of output)					
Within the state			1.22**	1.59**	1.04*
			(.32)	(.32)	(.57)
Within Mexico			1.87**	2.20**	1.6**
			(.47)	(.57)	(.46)
Exports			.77**	.92**	.30
			(.29)	(.26)	(.49)
SOURCE_INP (Source of inputs)					
Within the state				-.03	.03
				(.48)	(.56)
Within Mexico				-.43	-.15
				(.40)	(.56)

Imports				.28 (.56)	.46 (.70)
LOC (Location advantages)					
High quality workers					1.27 (5.36)
High quality material inputs and machines					4.25 (4.46)
Access and quality of infrastructure services					8.62* (5.04)
Contacts with international customers					.60 (2.90)
Informal links with local businessmen					3.00 (3.24)
Local demand for products					-.19 (1.87)
Government subsidies					-1.71 (1.80)
Level of rents for land and space					.66 (2.35)
Extent of congestion					-8.63 (7.97)
F-value *Adjusted* R^2	3.27 .19	3.79 .24	3.57 .36	5.13 .40	4.11 .46

** - significant at 5% level

* - significant at 10% level

Note: robust standard errors are presented below the coefficients

Table 4: OLS and 2SLS

	(10) Full model (OLS)	*(11) Full model (2SLS)*
LABOR (Human capital characteristics)		
Education	-14.62**	-15.24**
	(7.04)	(6.95)
Length of service	-3.21*	-3.11*
	(1.83)	(1.83)
Experience	-3.02	-3.05
	(3.36)	(3.37)
NETWORKS (Formal and informal networks)		
Formal visits	23.75**	22.88**
	(11.16)	(11.21)
Informal business lunches	21.87**	21.56**
	(9.81)	(9.70)
Informal other social engagements	-13.63	-13.83
	(11.85)	(11.74)
COMP (Competitive environment)		
Within city	.95	1.02
	(.90)	(.97)
Within state	1.06	1.01
	(1.20)	(1.22)
Within Mexico	-.03	-.02
	(.12)	(.12)
TECH (Technological innovation)		
No. of employees in new product development	-7.71	-5.37
	(27.29)	(26.80)
INF (Service interruptions in infrastructure provision)		
Electricity	.64	1.19
	(.67)	(.97)
Water	-.77	-.82
	(.56)	(.57)
Telephone	-.38	-.61*
	(.36)	(.35)
FIRM (Firm specific characteristics)		
Member of a group of firms	12.79	17.07
	(20.02)	(20.71)
Domestic partner	44.72*	45.89**
	(22.52)	(22.8)
Foreign partner	-20.26	-24.00
	(20.18)	(21.10)
DES_OUT (Destination of output)		
Within the state	1.10**	1.16**
	(.54)	(.53)
Within Mexico	1.70**	1.74**
	(.42)	(.42)
Exports	.24	.26
	(.48)	(.48)
SOURCE_INP (Source of inputs)		
Within the state	.07	.12
	(.58)	(.59)
Within Mexico	-.02	.02
	(.61)	(.61)

Imports	.59 (.75)	.67 (.38)
LOC (Location advantages)		
High quality workers	1.17 (5.37)	.71 (5.4)
High quality material inputs and machines	3.81 (4.26)	3.8 (4.2)
Access and quality of infrastructure services	9.74* (5.37)	9.9* (5.39)
Contacts with international customers	.93 (2.91)	.48 (3.02)
Informal links with local businessmen	3.13 (3.10)	3.33 (3.12)
Local demand for products	-.27 (1.83)	-.35 (1.81)
Government subsidies	-2 (1.89)	-2.16 (1.92)
Level of rents for land and space	.52 (2.35)	.68 (2.47)
Extent of congestion	-9.4 (8.21)	-10.59 (8.49)
BUS_REG (Policy environment)		
Policy environment	4.81 (3.78)	5.46 (3.85)
F-value *Adjusted* R^2	3.94 .48	4.06 .47

** - significant at 5% level
* - significant at 10% level
Note: robust standard errors are presented below the coefficients

Appendix 1: Variable definitions

Variable name	***Definition***
Dependent variable	
Lab_prod	Labor productivity – Sales (in thousand pesos)/Number of employees
Explanatory variable	
HUMAN CAPITAL	
Education Length of service Experience	Primary school or less – university Average length of service in the enterprise Average years of related experience prior to joining enterprise
NETWORKS	
Formal Informal business lunches Informal social engagements	Number of meetings in government committees or associations in the past year– city chambers of commerce, state chambers of commerce, national chambers of commerce, government committee on business promotion, government committee on infrastructure planning, association of entrepreneurs and individual business associations Number of business lunches during workday outside the workplace with local buyers and suppliers, foreign buyers and suppliers, competitors, government officials, other professionals in the past year Number of other social engagements outside the workplace with local buyers and suppliers, foreign buyers and suppliers, competitors, government officials, other professionals in the past year
COMP	
Within city Within state Within Mexico	Number of competitors within the city, in the state but outside the city, in Mexico but outside the state
DES_OUT	
Within state Within Mexico Exports	Percentage of output ultimately sold in each of the markets in 1992 – within state, within Mexico but outside state, exported
SOURCE_INP	
Within state Within Mexico Imports	Share of value of inputs purchased from each geographical source
TECH	
Technological innovation	Number of specialized employees engaged in new product development in 1992
INF	
Electricity Water Telephone	Number of service interruptions in 1992
FIRM	
Member of an enterprise group Domestic partner Foreign partner	Yes/No Yes/No Yes/No

LOC	
Loc	Advantages/disadvantages of current location from High quality workers, High quality material inputs and machines, Access and quality of infrastructure services, Contacts with international customers, Informal links with local businessmen, Local demand for products, Government subsidies, Level of rents for land and space, Extent of congestion
PE	
Bus_reg	Enterprise's perception of the impact of policies and regulatory instruments on enterprise profitability and overall growth. Policies include obtaining licenses for imports, requirement to meet export targets, requirement to export only through pre-specified trading agents, controls on prices of output, administratively determined input prices, and restrictions on hiring of workers

Appendix 2: Descriptive Statistics

Table A1: LABOR: Human capital characteristics

Variables	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Education	107	3.48	1.02	0	5.25
Length of service	107	5.68	4.51	0	26.25
Experience	107	2.40	2.68	0	13.5

Table A2: FIRM: firm specific characteristics

Variables	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Member of group of companies	107	.588	.494	0	1
Domestic jt. Venture partner	107	.196	.399	0	1
Foreign jt. Venture partner	107	.271	.446	0	1

Table A3: NETWORKS: Formal and informal networks

Variables	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Formal networks					
Local chambers of commerce	98	.67	1.29	0	5
State chambers of commerce	98	1.08	1.82	0	9
National chambers of commerce	98	2.74	1.84	0	5
Govt. committee on business promotion	98	.84	1.49	0	5
Govt. committee on infrastructure planning	98	1.03	1.70	0	5
Association of entrepreneurs and individual business associations	98	1.64	1.86	0	5
Others	98	2.58	2.22	0	6
Informal networks - Business lunches					
Local buyers and suppliers	98	2.68	2.02	0	8
Foreign buyers and suppliers	98	2.73	1.95	0	8
Foreign machinery supplier	98	1.60	1.46	0	5
Competitors	98	1.81	1.70	0	5
Government officials	98	2.60	1.85	0	5
Other professionals	98	3.43	1.85	0	5
Informal networks - Other social engagements					
Local buyers and suppliers	98	1.89	1.92	0	5
Foreign buyers and suppliers	98	1.37	1.62	0	5
Foreign machinery supplier	98	.94	1.26	0	5
Competitors	98	1.56	1.76	0	5
Government officials	98	1.60	1.70	0	5
Other professionals	98	2.79	2.13	0	5

Table A4: COMP: Competitive environment

Variable	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Number of competitors in 1992					
In the city	106	8.34	48.90	0	500
In the state (outside city)	106	4.19	12.89	0	80
In Mexico (outside state)	99	48.67	106.62	0	700

Table A5: INF: Access to infrastructure

Variable	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Limits of availability (Yes/No)					
Electricity	106	.235	.68	0	1
Water	105	.24	.43	0	1
Telephone	105	.23	.42	0	1
Service interruptions in 1992					
Electricity	105	9.35	17.52	0	99
Water	105	3.78	11.13	0	90
Telephone	105	10.62	19.99	0	99

Table A6: DEST_OUT, SOURCE_INP: Destination of outputs and source of inputs

Variable	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Destination of output in 1992					
Within state	107	35.05	38.35	0	100
Within Mexico outside state	107	24.09	30.12	0	95
Exports	107	40.28	44.74	0	100
Source of input in 1992					
Within state	107	8.19	21.27	0	100
Within Mexico outside state	107	32.97	34.52	0	100
Imports	107	50.54	39.55	0	100

Table A7: TECH: Technological innovation

Variable	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Number of employees in new product development	107	.79	1.61	0	10

Table A8: LOC – Location advantages/disadvantages

Variable	**No. of obs**	**Mean**	**Standard deviation**	**Min**	**Max**
High quality workers	105	4.27	1.98	1	7
High quality material inputs and machines	104	4.54	2.15	1	7
Access and quality of infrastructure services	105	4.09	1.78	1	7
Contacts with international customers	100	5.05	1.84	1	7
Informal links with local businessmen	98	4.86	1.69	1	7
Local demand for products	82	4.92	1.88	1	7
Government subsidies	54	3.96	1.54	1	7
Level of rents for land and space	96	3.21	1.37	1	7
Extent of congestion	105	3.27	1.46	1	6

Table A9: BUS_REG: Business regulatory environment

Variable	*No. of obs*	*Mean*	*Standard deviation*	*Min*	*Max*
Policy environment	73	1.56	1.50	0	5

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